The California Long Run County Employment and Output Forecasting System

A3-137-32

Executive Summary

Presented By:

Data Resources, Incorporated
April 1986

Executive Summary

The State Government Group at Data Resources, Inc.[1] (DRI) and the Research Division of the California Air Resources Board embarked upon a project to enhance the capabilities of county level economic projections used in the Air Pollution Emission Inventory Program. The Air Resources Board is required by State Health and Safety Code Section 39607(b) to inventory sources of air pollution within the air basins of the State to determine the kinds and quantities of air pollutants emitted. The inventory and projections are used for a variety of purposes including developing air resources management plans, evaluating control measures, analyzing new source impacts, modeling air quality, and measuring control program effectiveness. By enhancing the economic forecast capabilities, future year emission estimates would become more accurate and management plans could be implemented more effectively to achieve air quality goals based on future air quality standards and future year emissions.

[1] Data Resources, Inc. has been a provider of economic information and forecasts for over ten years. The Review of the U.S. Economy is published monthly and contains a forecast of the U.S. Economy for a twelve quarter forecast horizon. The State Government Group of Data Resources provides services to many state governments including state economic models used to forecast state economic conditions, tax revenue forecasting models, and various other speciality models. It has been the philosophy of the State Government Group not only to provide state agencies with tools, data and modeling expertise but also to rely heavily upon the expertise at the state level for subjective judgement and knowledge of local conditions and economic events.

Future year emissions for each combination of growth and control categories for a county portion of an air basin are calculated using the following equation:

EFY = EBY * GF * CF,

where

EFY= emissions for future year;

EBY= emissions for base year;

GF= growth factor, which is the ratio of economic activity in the future year to economic activity in the base year; and

CF= control factor, which is the ratio of the amount of control in the future year to the amount in the base year.

It can be seen from this simple equation that growth factors, which are dependent on national and state economic conditions, play a crucial role and could be a large source of error in the forecasts for future year emissions.

Therefore, the project plan was to provide enhanced economic forecasting at the county level by providing output and employment forecasts in an integrated system capable of utilizing:

1) a national economic forecast under different sets of economic assumptions;
2) a state level economic forecast of 77 industry input/output sectors consistent with the national forecast assumptions;
3) an apportionment methodology for estimating county level economic forecasts that are consistent with both national and state assumptions; and

4) a framework or system for quickly evaluating the effects of national economic changes on the state, county and emission forecasts.

The following example illustrates the importance of such an integrated system. The recent drop in oil prices has been analyzed at the national level by the Macroeconomic Group at DRI. Their forecasts, which embody this lower oil price, can be used to produce a state forecast which quantifies the effect of a lower oil price on growth in specific California industries. This sectoral growth is then translated to county growth via the apportionment methodology described in the report. These new growth factors can then be applied to the equation, EFY = EBY * GF * CF, to calculate the effect of lower oil prices on future year emissions.

The majority of the work performed under contract A3-137-32 was in developing and implementing a theoretically sound methodology for apportioning statewide output to the 58 county, 77 industry sector level of detail.

Three different approaches for developing county level forecasts were discussed with the ARB's Research Division staff. The discussions centered on the strengths and weaknesses of the three methodologies and the implied assumptions concerning the counties' growth vis-a-vis the rest of the state. All three are discussed in more detail in the body of the report, but the following brief description outlines the basic assumptions.

Method 1 The county shares of the California industry sectorial total are assumed to be fixed. For example, if Los Angles county had 10% of all employment in the petroleum refining industry in 1981, it would be assumed to have the same 10% share throughout the forecast period.

Method 2 County shares are based on long-term (10 year) growth toward U.S. sectorial share. For example, if it is assumed that the petroleum industry share was 10% of Los Angeles County employment in 1981, and in 1995 will be 15% of all employment at the national level, then between 1981 and 1995 the Los Angeles County employment share of the petroleum industry will move toward the U.S. share of the same industry. Therefore, by 1995 the petroleum industry share will be 15% of all employment in Los Angeles County.

Method 3 Method 3 involves adjusting the base year county employment share to be consistent with the sum of all California county sectorial employment <u>and</u> the sum of California county total employment for each of the forecast years. This method involves a modification of a matrix adjustment process know as the R.A.S. Technique. It is discussed in more detail in the body of the report.

The end product of all three of these methods is county level growth forecasts for each of the 58 California counties in each of the 77 input/output sectors. Method 3 was used to produce the final forecast. After several discussions with the Air Resources Board's Research Division staff about the strengths of that method, it was deemed to be more appropriate than the alternatives.

What follows is a summary of the results for the State of California and selected counties. The summary includes tables that identify the ten sectors of the California economy which have the highest forecasted growth over the period 1983 to 1995, sector employment for 1986 through 1995 for the 77 industrial sectors, real dollar output levels for 1995 for the 77 industrial sectors including percentage growths of output by sector, and graphs of various county employment growth in several sectors.

RECOMMENDATIONS FOR FUTURE STUDY

Future contract work with ARB will be based on the utilization of the economic growth projections made under the terms of this contract. It is DRI's intention to work with the ARB to establish an ongoing forecasting program which will enable the ARB to update their forecasts on an annual basis. DRI proposes to work with ARB staff to keep appraised of their evolving needs for economic growth forecasts. Based on these current requirements and needs, we propose to refine and expand the California model.

We propose to include California as a tenth region in the regional breakdown of the U.S., and to divide California into several subregions which could correspond to the ARB's emission inventory district classification. By subdividing California into several areas, each area's share of each industry's employment will be explained within the state. This work would overcome the current model's inability to examine intra-California shifts in industrial employment and would provide the ARB with a state-of-the-art California long-run forecasting model.

CALIFORNIA'S TEN HIGHEST GROWTH SECTORS

*** CALIFORNIA ***

Employment (Thousands of Employees)

Sectors	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
57. ELECTRONIC COMPONENTS & ACCESS.	165	176	184	193	205	219	229	238	246	253	258	264	271
48. SPECIAL INDUSTRY MACHINERY	12	13	14	14	15	16	16	17	17	18	18	19	19
62. INSTRUMENTS & SUPPLIES	60	65	68	70	74	78	81	84	86	89	91	93	95
53. ELECTRICAL MACHINERY	37	40	40	42	44	46	48	49	51	52	53	54	56
73. BUSINESS SERVICES	948	1,025	1,076	1,111	1,152	1,196	1,234	1,268	1,296	1,328	1,356	1,380	1,407
47. METALWORKING MACH. & EQ.	16	19	19	19	20	21	21	22	22	23	23	23	24
51. OFFICE,COMPUTING & ACCT. MACH.	124	138	145	148	155	162	166	168	170	173	176	178	180
45. CONSTR. & MINING MACHINERY	13	15	15	15	16	16	17	17	17	18	18	19	19
54. HOUSEHOLD APPLIANCES	7	8	8	9	9	9	9	10	10	10	10	10	11
63. OPTICAL,OPHTHALMIC & PHOTO EQ.	22	24	24	25	27	28	29	29	30	30	31	31	32

Sectors	%GR 83-95	Average Share of CA Total	Average Share of US Total
57. ELECTRONIC COMPONENTS & ACCESS.	4.3	2.1	29.3
48. SPECIAL INDUSTRY MACHINERY	3.9	0.2	6.6
62. INSTRUMENTS & SUPPLIES	3.9	0.8	18.9
53. ELECTRICAL MACHINERY	3.5	0.5	10.8
73. BUSINESS SERVICES	3.3	11.6	14.1
47. METALWORKING MACH. & EQ.	3.3	0.2	6.1
51. OFFICE,COMPUTING & ACCT. MACH.	3.1	1.5	27.3
45. CONSTR. & MINING MACHINERY	3.1	0.2	7.5
54. HOUSEHOLD APPLIANCES	3.0	0.1	5.0
63. OPTICAL,OPHTHALMIC & PHOTO EQ.	2.9	0.3	11.8

DRI Regional Industry Forecast 0684

*** CALIFORNIA ***

Employment (Thousands of Employees)

Sectors	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	%GR 83-95	Average Share of CA Total	Average Share of US Total
1. LIVESTOCK & PRODUCTS	33	32	31	31	30	29	28	28	28	28	-1.9	0.4	5.9
2. OTHER AGRICULTURAL PRODUCTS	54	52	52	51	50	49	48	48	48	48	-1.0	0.6	12.7
3. FORESTRY & FISHERY PRODUCTS	13	13	13	13	13	13	12	12	12	12	-1.7	0.1	12.7
4. AGR.,FORESTRY,&FISHERY SERV.	46	46	46	45	44	43	43	43	43	43	-0.8	0.5	12.7
5. IRON ORE MINING	2	1	1	2	1	1	1	1	1	1	-1.0	0.0	8.1
6. NONFERROUS METAL MINING	1	1	1	1	1	1	1	1	1	1	0.8	0.0	1.8
7. COAL MINING	0	0	0	0	0	0	0	0	0	0	0.7	0.0	0.0
8. CRUDE PETROLEUM & N. GAS	21	21	20	20	19	19	18	18	17	17	-0.2	0.2	7.8
9. STONE&CLAY MINING & QUARRYING	7	8	8	8	8	8	8	8	8	8	1.2	0.1	7.4
10. CHEM&FERTILIZER MIN. MINING	2	2	2	2	2	2	2	2	2	2	1.0	0.0	13.1
11. NEW CONSTRUCTION	577	587	583	568	544	538	546	542	524	511	2.0	5.1	10.9
12. MAINTENANCE & REPAIR CONSTR.	308	307	303	295	284	284	291	291	283	277	1.9	2.6	10.0
13. ORDNANCE & ACCESSORIES	113	117	123	127	130	132	135	137	139	142	2.7	1.2	45.4
14. FOOD & KINDRED PRODUCTS	183	184	185	185	185	185	185	185	185	185	0.2	2.1	10.5
15. TOBACCO MANUFACTURES	0	0	0	0	0	0	0	0	0	0	-3.5	0.0	0.0
16. FABRIC,YARN & THREAD MILLS	3	3	3	3	3	3	3	3	3	3	-0.5	0.0	0.7
17. MISC. TEXTILE GOODS	8	7	7	7	7	7	7	7	7	8	-0.6	0.1	6.1
18. APPAREL	117	118	120	121	121	121	121	120	119	119	0.9	1.2	7.9
19. MISC. FABRICATED TEXTILE PROD.	22	23	23	24	24	24	24	24	24	24	2.3	0.2	10.4
20. LUMBER & WOOD PRODUCTS	49	49	50	51	51	51	51	52	53	53	1.0	0.6	7.6
21. WOOD CONTAINERS	2	2	2	2	2	2	2	2	2	2	0.6	0.0	10.8
22. HOUSEHOLD FURNITURE	40	40	41	41	41	42	42	42	43	43	1.5	0.4	11.3
23. OTHER FURNITURE & FIXTURES	25	25	26	26	27	27	27	28	29	29	2.7	0.2	12.2
24. PAPER & ALLIED PRODUCTS	24	24	25	25	25	26	26	26	26	27	1.5	0.3	4.9
25. PAPERBOARD CONTAINERS & BOXES	17	17	17	17	17	18	18	18	18	18	1.2	0.2	8.1
26. PRINTING & PUBLISHING	69	71	73	74	75	76	77	78	78	79	1.7	0.7	9.0
27. CHEMICALS & PRODUCTS	21	22	22	22	22	23	23	23	24	24	1.1	0.3	4.8
28. PLASTICS & SYNTHETIC MATLS.	5	5	5	5	5	5	5	6	6	6	1.4	0.1	2.7
29. DRUGS,CLEANING & TOILET PREP.	33	33	34	35	35	36	37	38	38	39	1.4	0.4	9.4
30. PAINTS & ALLIED PRODUCTS	9	9	9	10	10	10	10	10	10	10	1.5	0.1	12.6
31. PET REFINING & REL. PROD.	32	32	32	32	32	32	32	32	32	32	0.7	0.3	13.2
32. RUBBER & MISC. PLASTICS PROD.	80	83	86	88	89	92	93	95	96	98	2.8	0.8	9.4
33. LEATHER TANNING & FINISHING	2	2	2	2	2	2	2	2	2	2	0.7	0.0	7.1
34. FOOTWEAR & OTHER LEATHER PROD.	11	11	12	12	12	12	12	12	12	12	0.5	0.1	5.4
35. GLASS & GLASS PRODUCTS	19	19	19	19	19	19	19	20	20	20	1.0	0.2	10.2
36. STONE & CLAY PRODUCTS	37	37	38	38	38	38	38	38	38	38	1.1	0.4	8.6
37. PRIMARY FERROUS METALS	23	24	25	25	25	25	25	25	25	25	1.3	0.3	3.7
38. NONFERROUS METALS	22	23	24	25	25	26	26	26	26	27	2.3	0.3	6.6
39. METAL CONTAINERS	9	9	9	9	9	9	9	9	10	10	0.7	0.1	14.7
40. FAB. STRUCTURAL METAL PRODUCTS	47	49	50	51	52	53	53	54	55	56	2.4	0.5	9.7
41. SCREW MACHINE PROD.&STAMPINGS	26	27	28	28	29	29	29	30	30	30	2.4	0.3	7.3
42. OTHER FAB. METAL PRODUCTS	60	62	65	67	68	70	71	73	74	75	2.8	0.7	10.3
43. ENGINES & TURBINES	7	7	8	8	8	8	8	8	8	8	1.3	0.1	5.8
44. FARM & GARDEN MACHINERY	5	5	5	5	5	6	6	6	6	6	2.3	0.1	4.0

DRI Regional Industry Forecast 0684

*** CALIFORNIA ***

Employment (Thousands of Employees)

Sectors	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	%GR 73-95	Average Share of CA Total	Average Share of US Total
44. FARM & GARDEN MACHINERY	5	5	5	5	5	6	6	6	6	6	1.1	0.1	4.0
45. CONSTR. & MINING MACHINERY	15	16	16	17	17	17	18	18	19	19	2.6	0.2	6.7
46. MATERIALS HANDLING MACH. & EQ.	6	7	7	7	7	7	7	7	8	8	2.4	0.1	6.3
47. METALWORKING MACH. & EQ.	19	20	21	21	22	22	23	23	23	24	3.1	0.2	5.4
48. SPECIAL INDUSTRY MACHINERY	14	15	16	16	17	17	18	18	19	19	3.0	0.2	6.1
49. GENERAL INDUSTRY MACHINERY	23	24	25	25	26	26	27	28	28	29	3.1	0.2	6.9
50. MISC. NONELECTRICAL MACH.	39	40	41	42	43	44	44	45	45	46	3.0	0.4	14.2
51. OFFICE,COMPUTING & ACCT. MACH.	148	155	162	166	168	170	173	176	178	180	5.4	1.3	26.4
52. SERVICE INDUSTRY MACHINES	11	12	12	13	13	13	13	14	14	14	2.3	0.1	5.7
53. ELECTRICAL MACHINERY	42	44	46	48	49	51	52	53	54	56	3.6	0.4	9.4
54. HOUSEHOLD APPLIANCES	9	9	9	9	10	10	10	10	10	11	3.9	0.1	4.3
55. ELECTRIC LIGHTING & WIRING EQ.	17	18	19	19	19	19	20	20	20	20	2.8	0.2	8.6
56. RADIO,TV, & COMMUNICATION EQ.	166	172	177	180	182	184	185	187	188	189	3.4	1.6	19.7
57. ELECTRONIC COMPONENTS & ACCESS.	193	205	219	229	238	246	253	258	264	271	5.1	1.9	27.6
58. MISC. ELECTRICAL MACH. & EQ.	10	11	11	11	12	12	12	12	12	12	3.2	0.1	7.0
59. MOTOR VEHICLES & EQUIPMENT	51	51	52	53	54	55	56	56	57	57	0.8	0.6	6.1
60. AIRCRAFT & PARTS	140	144	150	154	158	161	164	167	170	174	1.6	1.5	23.2
61. OTHER TRANSPORTATION EQ.	33	33	34	34	34	34	35	35	35	35	-0.7	0.4	8.6
62. INSTRUMENTS & SUPPLIES	70	74	78	81	84	86	89	91	93	95	4.9	0.7	16.8
63. OPTICAL,OPHTHALMIC & PHOTO EQ.	25	27	28	29	29	30	30	31	31	32	5.3	0.2	10.3
64. MISC. MANUFACTURING	44	45	46	47	48	48	49	50	50	51	2.1	0.5	9.8
65. TRANSPORTATION & WAREHOUSING	352	360	370	378	384	389	394	400	405	410	1.9	3.8	11.1
66. COMMUNICATION EXC. RADIO & TV	151	155	160	163	166	167	169	170	172	173	1.9	1.6	13.3
67. RADIO & TV BROADCASTING	0	0	0	0	0	0	0	0	0	0	3.3	0.0	10.9
68. UTILITIES	79	80	81	82	83	83	84	84	85	86	2.0	0.8	8.8
69. WHOLESALE & RETAIL TRADE	1,777	1,822	1,874	1,911	1,936	1,962	1,988	2,010	2,029	2,048	2.3	18.3	10.9
70. FINANCE & INSURANCE	581	603	625	644	661	674	687	699	710	722	3.8	5.7	11.8
71. REAL ESTATE & RENTAL	225	233	239	243	246	248	250	252	254	256	2.8	2.3	14.1
72. PERSONAL SERVICES EXC. AUTO.	253	260	268	274	279	283	287	292	295	299	2.0	2.7	11.1
73. BUSINESS SERVICES	1,111	1,152	1,196	1,234	1,268	1,296	1,328	1,356	1,380	1,407	4.7	10.6	13.6
74. EATING & DRINKING PLACES	754	768	782	793	800	805	813	819	823	827	3.2	7.4	12.2
75. AUTOMOBILE REPAIR & SERVICE	176	181	185	189	191	193	195	197	199	201	2.5	1.9	14.2
76. AMUSEMENTS	203	208	214	219	223	227	231	234	238	241	2.8	2.1	19.2
77. MISC. SERVICES	982	1,012	1,051	1,083	1,110	1,133	1,160	1,184	1,205	1,228	3.5	10.0	10.2

DRI Regional Industry Forecast 0684

*** CALIFORNIA ***

Real Output (Millions of 1972 $)

Sectors	1995	%GR 83-95	Average Share of CA Total	Average Share of US Total
1. LIVESTOCK & PRODUCTS	2,697	-0.3	0.9	5.9
2. OTHER AGRICULTURAL PRODUCTS	7,286	1.7	2.1	12.7
3. FORESTRY & FISHERY PRODUCTS	422	-0.2	0.1	12.7
4. AGR.,FORESTRY,&FISHERY SERV.	733	0.8	0.2	12.7
5. IRON ORE MINING	163	0.8	0.0	8.1
6. NONFERROUS METAL MINING	19	0.9	0.0	1.0
7. COAL MINING	3	2.6	0.0	0.0
8. CRUDE PETROLEUM & N. GAS	1,132	0.8	0.4	7.8
9. STONE&CLAY MINING & QUARRYING	369	3.0	0.1	7.4
10. CHEM&FERTILIZER MIN. MINING	87	2.6	0.0	13.1
11. NEW CONSTRUCTION	16,757	3.1	4.6	10.8
12. MAINTENANCE & REPAIR CONSTR.	6,655	3.7	1.6	10.1
13. ORDNANCE & ACCESSORIES	5,764	5.0	1.2	49.4
14. FOOD & KINDRED PRODUCTS	17,670	2.3	4.7	9.4
15. TOBACCO MANUFACTURES	1	-2.0	0.0	0.0
16. FABRIC,YARN & THREAD MILLS	141	1.0	0.0	0.7
17. MISC. TEXTILE GOODS	665	0.9	0.2	6.9
18. APPAREL	3,245	2.6	0.8	7.4
19. MISC. FABRICATED TEXTILE PROD.	985	3.7	0.2	10.4
20. LUMBER & WOOD PRODUCTS	2,222	2.5	0.6	7.0
21. WOOD CONTAINERS	45	2.8	0.0	10.8
22. HOUSEHOLD FURNITURE	1,374	3.5	0.3	11.8
23. OTHER FURNITURE & FIXTURES	1,032	4.6	0.2	12.1
24. PAPER & ALLIED PRODUCTS	1,582	3.2	0.4	4.3
25. PAPERBOARD CONTAINERS & BOXES	1,044	3.3	0.3	8.1
26. PRINTING & PUBLISHING	2,962	3.7	0.7	8.6
27. CHEMICALS & PRODUCTS	2,096	4.0	0.5	4.6
28. PLASTICS & SYNTHETIC MATLS.	809	5.8	0.2	3.0
29. DRUGS,CLEANING & TOILET PREP.	3,573	3.8	0.8	9.6
30. PAINTS & ALLIED PRODUCTS	785	3.8	0.2	12.6
31. PET REFINING & REL. PROD.	5,425	1.4	1.6	13.9
32. RUBBER & MISC. PLASTICS PROD.	4,566	5.2	0.9	9.1
33. LEATHER TANNING & FINISHING	66	1.6	0.0	7.1
34. FOOTWEAR & OTHER LEATHER PROD.	231	1.0	0.1	5.6
35. GLASS & GLASS PRODUCTS	918	3.7	0.2	10.0
36. STONE & CLAY PRODUCTS	1,780	3.5	0.5	8.6
37. PRIMARY FERROUS METALS	1,515	3.9	0.4	3.4
38. NONFERROUS METALS	1,886	5.0	0.4	5.0
39. METAL CONTAINERS	888	2.4	0.3	15.3
40. FAB. STRUCTURAL METAL PRODUCTS	2,371	4.1	0.6	9.6
41. SCREW MACHINE PROD.&STAMPINGS	1,303	4.9	0.3	7.0
42. OTHER FAB. METAL PRODUCTS	3,171	5.4	0.7	10.1
43. ENGINES & TURBINES	448	4.6	0.1	5.3
44. FARM & GARDEN MACHINERY	367	5.0	0.1	4.1

DRI Regional Industry Forecast 0684

***** CALIFORNIA *****

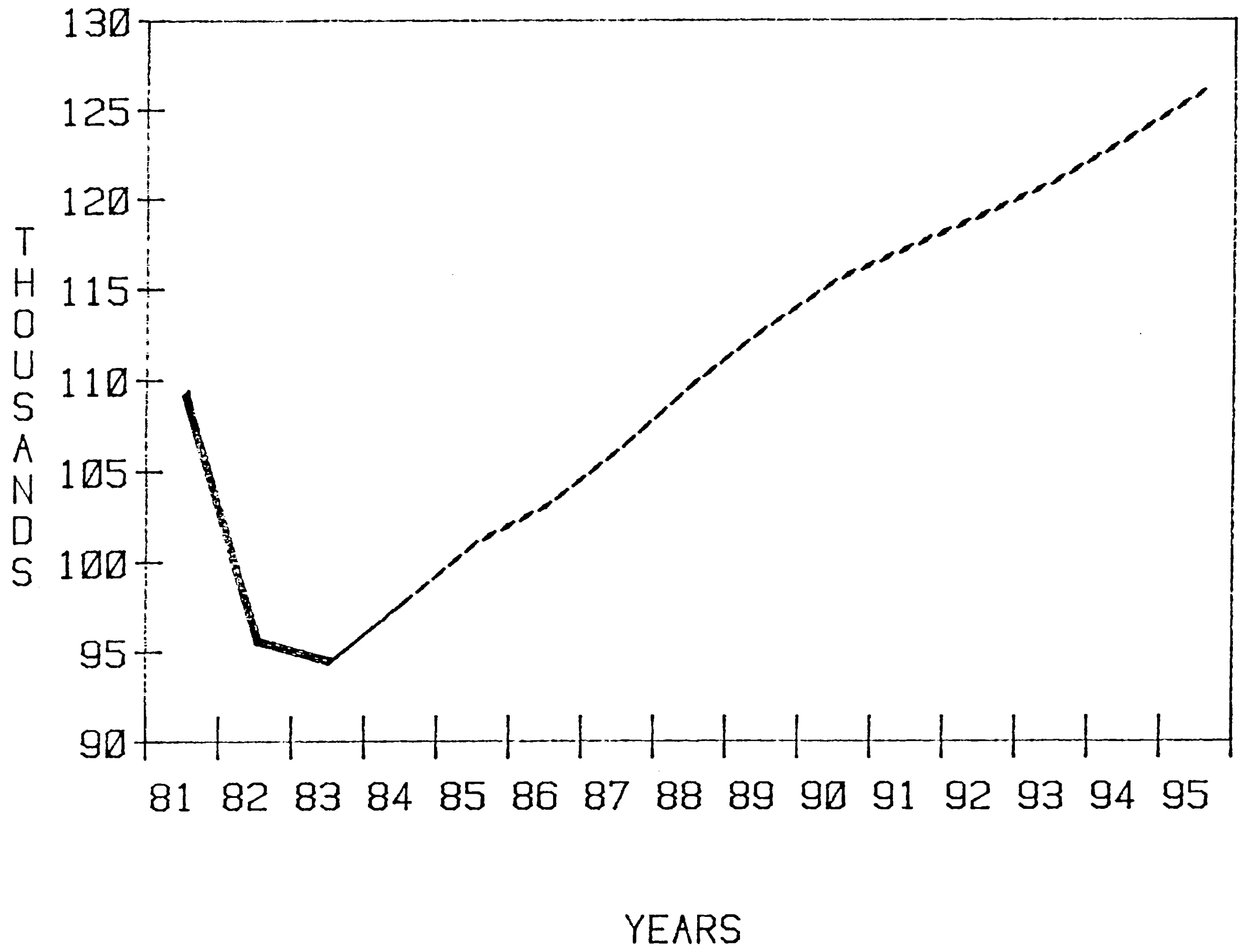
Real Output (Millions of 1972 $)

Sectors	1995	%GR 83-95	Average Share of CA Total	Average Share of US Total
45. CONSTR. & MINING MACHINERY	928	5.9	0.2	6.6
46. MATERIALS HANDLING MACH. & EQ.	400	5.4	0.1	6.4
47. METALWORKING MACH. & EQ.	807	6.4	0.2	5.3
48. SPECIAL INDUSTRY MACHINERY	640	5.8	0.1	6.2
49. GENERAL INDUSTRY MACHINERY	1,243	5.1	0.3	7.1
50. MISC. NONELECTRICAL MACH.	1,551	4.5	0.3	14.2
51. OFFICE,COMPUTING & ACCT. MACH.	33,685	9.1	4.3	27.3
52. SERVICE INDUSTRY MACHINES	775	4.7	0.2	5.2
53. ELECTRICAL MACHINERY	2,447	6.2	0.5	9.4
54. HOUSEHOLD APPLIANCES	625	4.9	0.1	4.1
55. ELECTRIC LIGHTING & WIRING EQ.	812	4.5	0.2	8.7
56. RADIO,TV, & COMMUNICATION EQ.	13,606	5.7	2.3	18.9
57. ELECTRONIC COMPONENTS & ACCESS.	19,959	8.1	2.8	28.6
58. MISC. ELECTRICAL MACH. & EQ.	576	4.1	0.1	6.9
59. MOTOR VEHICLES & EQUIPMENT	7,738	4.7	1.8	6.9
60. AIRCRAFT & PARTS	8,187	5.0	1.8	23.7
61. OTHER TRANSPORTATION EQ.	1,420	2.6	0.4	9.1
62. INSTRUMENTS & SUPPLIES	3,322	6.3	0.6	16.5
63. OPTICAL,OPHTHALMIC & PHOTO EQ.	2,155	6.0	0.4	9.4
64. MISC. MANUFACTURING	2,038	3.6	0.4	10.1
65. TRANSPORTATION & WAREHOUSING	14,553	3.6	3.6	11.4
66. COMMUNICATION EXC. RADIO & TV	18,314	6.3	3.1	13.3
67. RADIO & TV BROADCASTING	1	4.3	0.0	10.9
68. UTILITIES	7,554	2.5	2.0	8.1
69. WHOLESALE & RETAIL TRADE	45,659	3.8	10.6	10.9
70. FINANCE & INSURANCE	23,189	4.4	4.7	11.6
71. REAL ESTATE & RENTAL	57,837	3.9	12.6	14.2
72. PERSONAL SERVICES EXC. AUTO.	4,467	2.9	1.2	11.2
73. BUSINESS SERVICES	35,255	4.9	6.9	13.2
74. EATING & DRINKING PLACES	10,200	2.9	2.5	12.2
75. AUTOMOBILE REPAIR & SERVICE	7,009	4.3	1.6	14.2
76. AMUSEMENTS	6,727	2.9	1.6	21.4
77. MISC. SERVICES	23,045	4.5	4.8	11.0

DRI Regional Industry Forecast 0684

LOS ANGELES COUNTY

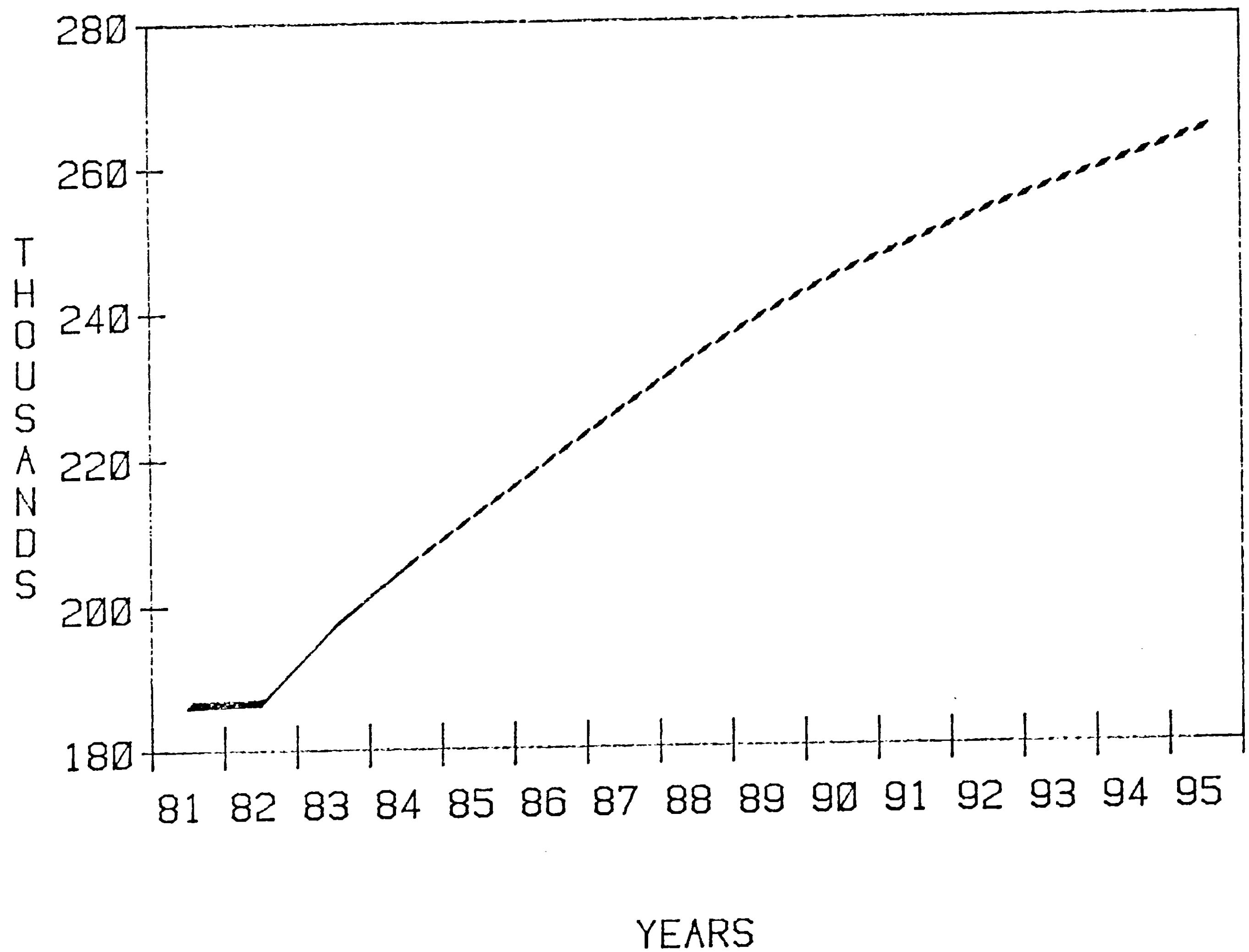
EMPLOYMENT -- AIRCRAFT & PARTS



AIR RESOURCES BOARD

DATA RESOURCES, INC.

LOS ANGELES COUNTY
EMPLOYMENT IN FINANCE AND INSURANCE

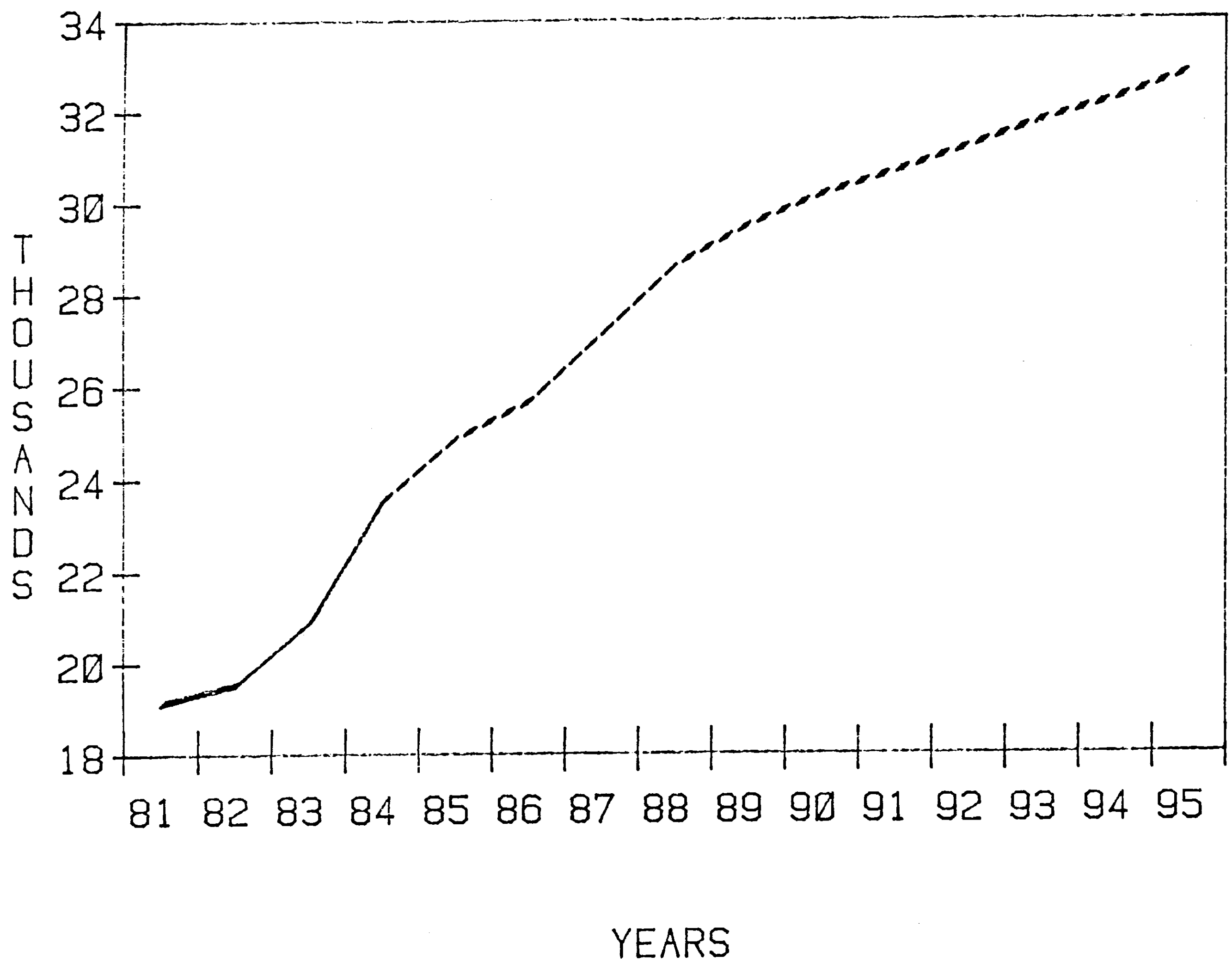


AIR RESOURCES BOARD

DATA RESOURCES, INC.

ORANGE COUNTY

EMPLOYMENT -- OFFICE, COMPUTING & ACCOUNTING MACHINERY

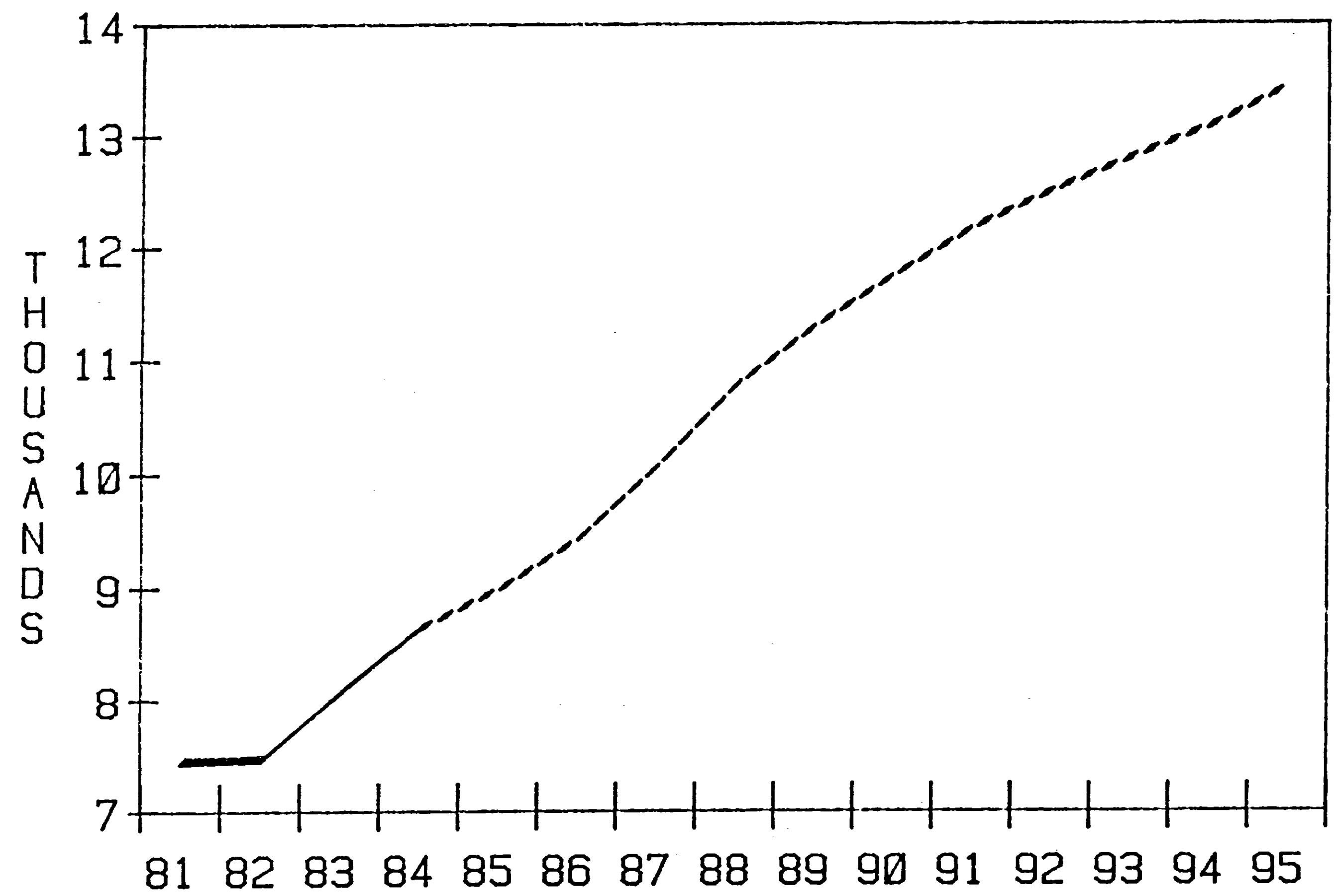


AIR RESOURCES BOARD

DATA RESOURCES, INC.

SAN DIEGO COUNTY

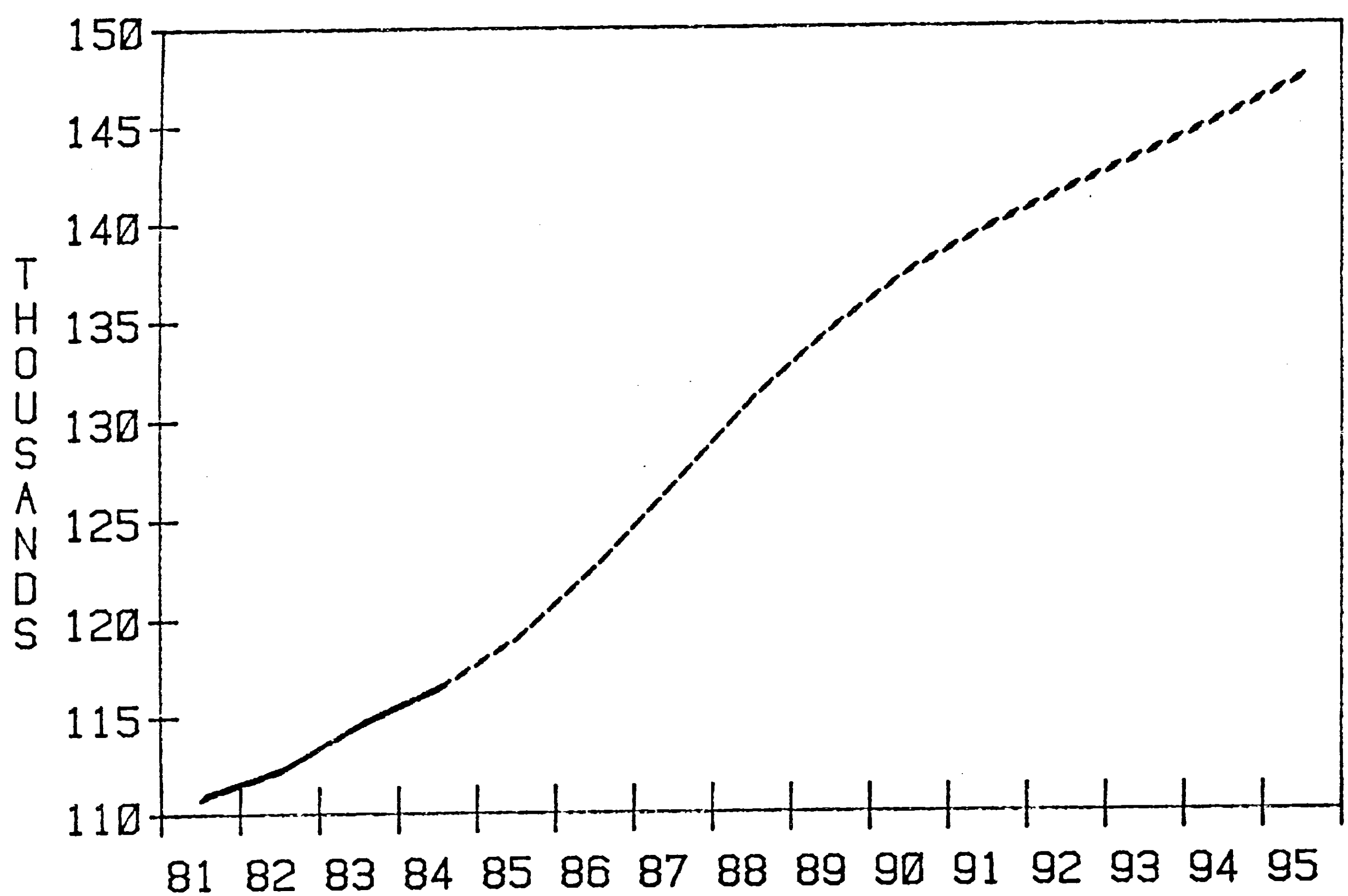
EMPLOYMENT -- ELECTRONIC COMPONENTS & ACCESSORIES



AIR RESOURCES BOARD

DATA RESOURCES, INC.

SAN FRANCISCO-OAKLAND SMSA
EMPLOYMENT IN FINANCE & INSURANCE

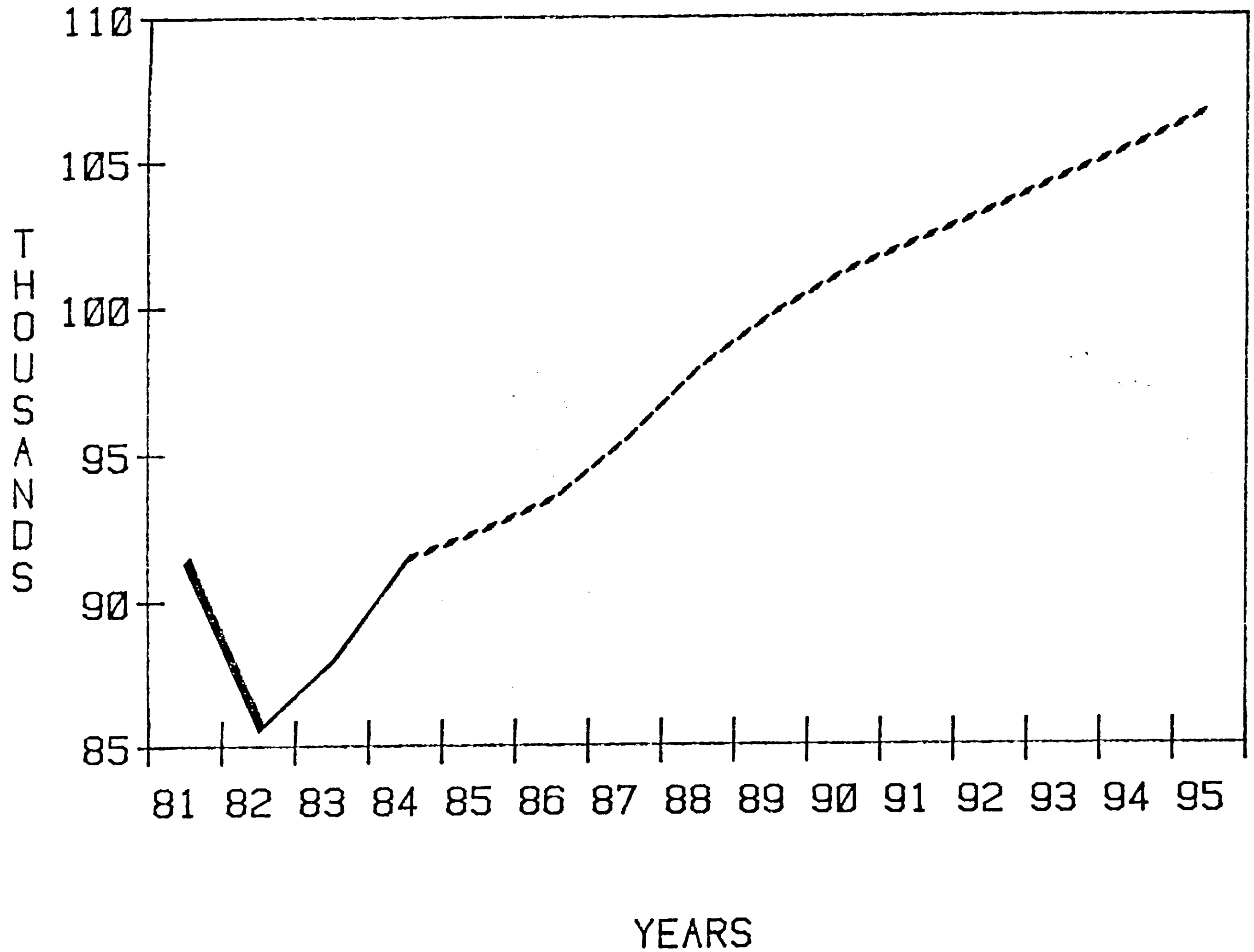


AIR RESOURCES BOARD

DATA RESOURCES, INC.

SAN FRANCISCO-OAKLAND SMSA

EMPLOYMENT -- TRANSPORTATION & WAREHOUSING



AIR RESOURCES BOARD

DATA RESOURCES, INC.

The California Long Run County Employment and Output

Forecasting System

Presented By:

Data Resources, Incorporated
April 1986

Abstract

The purpose of this work is to provide the California Air Resources Board with a system for updating forecasts of industrial growth factors used in the statewide Emission Inventory System. Of special importance is a method for forecasting industrial growth by counties. Hence, the majority of the work performed under contract A3-237-32 was in developing and implementing a theoretical methodology for apportioning state output to the county level. A proportional matrix adjustment is utilized as the core of the system that apportions the state forecast to the counties. This matrix adjustment process is dependent on state industry forecasts which are provided by the Data Resources, Incorporated industry forecasting component and county total employment forecasts. Within the scope of the work, DRI provides a California forecast of employment and real output to the year 1995 for 77 industries and 58 counties.

The system developed provides the ability to forecast state and county output and employment under different sets of economic assumptions which can be used to analyze the effects of national economic changes. It also provides a theoretical methodology for estimating county level sector forecasts for the 58 California counties.

Acknowledgements

I wish to thank Steve Storelli, Project Manager for the Air Resources Board, and other staff of the Economic Studies Section of the Research Division of the Air Resources Board for their valuable comments, Amy Reece for her valuable assistance and especially the administrative staff of DRI's San Francisco office for their kind patience.

This report was submitted in fulfillment of Contract A3-137-32, Long-Run Statewide Economic Forecasting Project, by Data Resources Inc. under the sponsorship of the California Air Resources Board. Work was completed as of September 28, 1985.

Lew Hurt
Principal Investigator
September, 1985

Disclaimer

The statements and conclusions in this report are those of the contractor and not necessarily those of the California Air Resources Board. The mention of commercial products, their source or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.

TABLE OF CONTENTS

I. Introduction

The State Government Group at Data Resources, Inc.[1] (DRI) and the Research Division of the California Air Resources Board embarked upon a project to enhance the capabilities of county level economic projections used in the Air Pollution Emission Inventory Program. The Air Resources Board is required by State Health and Safety Code Section 39607(b) to inventory sources of air pollution within the air basins of the State to determine the kinds and quantities of air pollutants emitted. The inventory and projections are used for a variety of purposes including developing air resources management plans, evaluation of control measures, analyzing new source impacts, modeling air quality, and measuring control program effectiveness. By enhancing the economic forecast capabilities, future year emission estimates would become more accurate and management plans could be implemented more effectively to achieve air quality goals based on future air quality standards and future year emissions.

[1] Data Resources, Inc. has been a provider of economic information and forecasts for over ten years. The Review of the U.S. Economy is published monthly and contains a forecast of the U.S. Economy for a twelve quarter forecast horizon. The State Government Group of Data Resources provides services to many state governments including state economic models used to forecast state economic conditions, tax revenue forecasting models and various other speciality models. It has been the philosophy of the State Government Group not only to provide state agencies with tools, data and modeling expertise but also to rely heavily upon the expertise at the state level for subjective judgement and knowledge of local conditions and economic events.

Future year emissions for each combination of growth and control categories for a county portion of an air basin are calculated using the following equation:

EFY = EBY * GF * CF,

where

EFY= emissions for future year;

EBY= emissions for base year;

GF= growth factor, which is the ratio of economic activity in the future year to economic activity in the base year; and

CF= Control factor, which is the ratio of the amount of control in the future year to the amount in the base year.

It can be seen from this simple equation that growth factors, which are dependent on national and state economic conditions, play a crucial role and could be a large source of error in the forecasts for future year emissions.

Therefore, the project plan was to provide enhanced economic forecasting at the county level by providing output and employment forecasts in an integrated system capable of utilizing:

1) a national economic forecast under different sets of economic assumptions;
2) a state level economic forecast of 77 industry input/output sectors consistent with the national forecast assumptions;
3) an apportionment methodology for estimating county level economic forecasts that are consistent with both national and state assumptions; and

4) a framework or system for quickly evaluating the effects of national economic changes on the state, county and finally emission forecasts.

The following example illustrates the importance of such an integrated system. The recent drop in oil prices has been analyzed at the national level by the Macroeconomic Group at DRI. Their forecasts, which embody this lower oil price, can be used to produce a state forecast which quantifies the effect of a lower oil price on growth in specific California industries. This sectoral growth is then translated to county growth via the apportionment methodology described later in this report. These new growth factors can then be applied to the equation, EFY = EBY * GF * CF, to calculate the effect of lower oil prices on future year emissions.

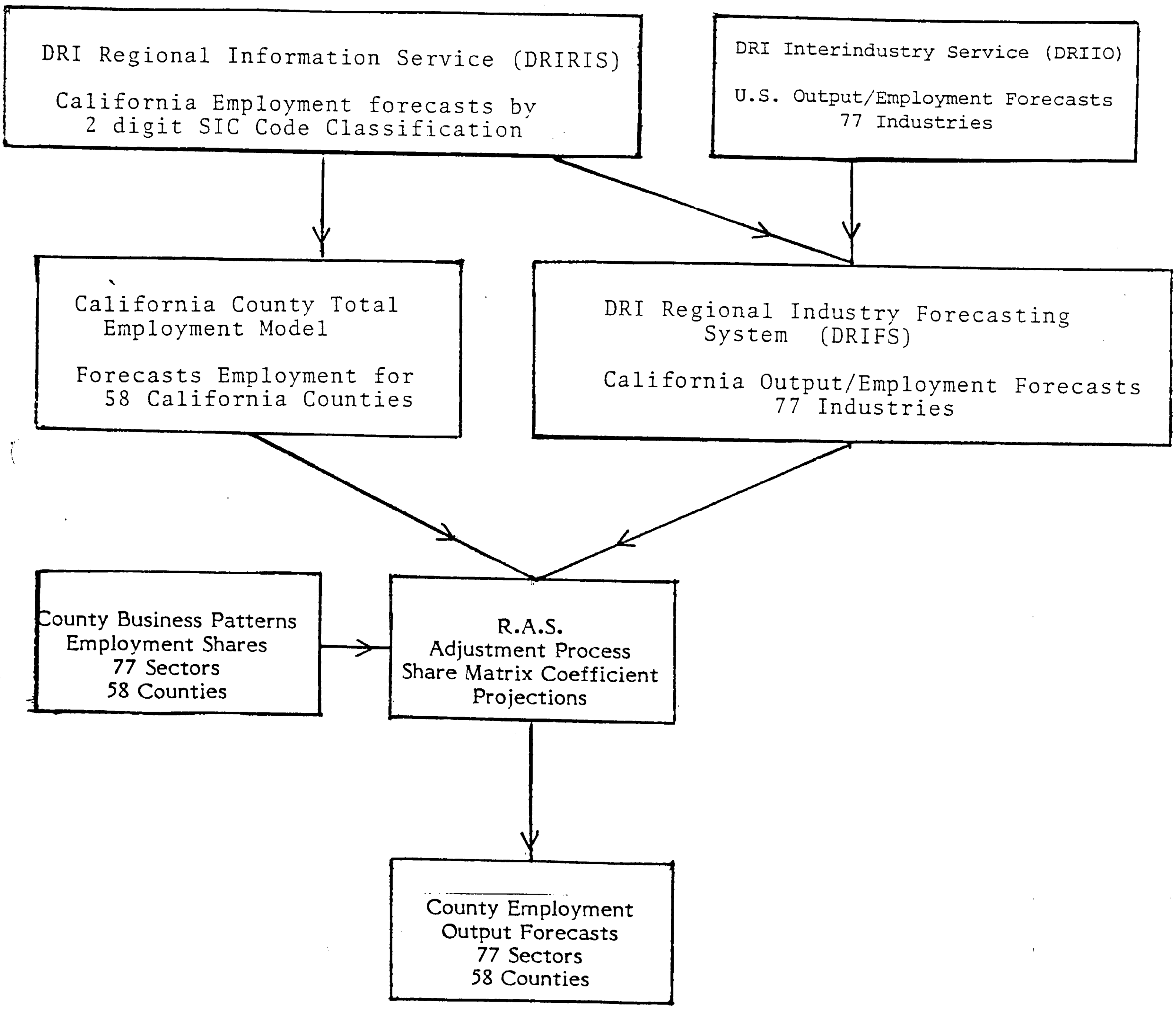
The majority of the work performed under contract A3-137-32 was in developing and implementing a theoretically sound methodology for apportioning statewide output to the 58 county, 77 industry sector level of detail.

The result of the work performed under this contract is entitled The California Long-Run County Employment and Output Forecasting System. A brief description of the various component parts of the California Long-Run (10 year) County Forecasting System, which was produced under the contract between the Air Resources Board and Data Resources, Inc., is provided below. Figure 1 illustrates the complete system.

1) The Data Resources Regional Information System (DRIRIS). This system provides California employment forecasts by 2 digit Manufacturing Standard Industrial Classification (SIC) Code (Described in Appendix V).

Figure 1

The California County Forecasting System



2) The Data Resources Interindustry Service (DRIIO). The Interindustry Models are utilized to produce national level output for 77 industries. (National Model is discussed in Appendix VI).

3) The Data Resources Regional Industry Forecasing System (DRIFS). The Regional Industry Forecasting System links together the Interindustry (DRIIO) and Regional (DRIRIS) Models to provide annual output and employment forecasts at the state level for 77 industries. This linkage is described in Appendix VII.

4) The California County Total Employment Model (CACTEM). This model was developed for the Air Resources Board under contract A3-137-32. It forecasts employment for the 58 California counties and is utilized in apportioning State output for 77 industries to the county level. The Model is described in the body of the report, and regression statistics for all the stochastic equations are located in Appendix VIII.

5) The California Long-Run (10 year) County Forecasting System (CALCFS). This system integrates forecasts from the Data Resources Industry Forecasting System (DRIFS) and the California County Total Employment Model (CACTEM) to produce county level forecasts for 77 industries. The methods for providing this integration and producing county level forecasts are discussed below.

Three different approaches for producing county level forecasts were discussed with the ARB's Research Division staff. The discussions centered on the strengths and weaknesses of the three methodologies and the implied assumptions concerning the counties' growth vis-a-vis the rest of state. All three are discussed in more detail in the body of the report but the following brief description outlines the basic assumptions.

Method 1 The county shares of the California industry sectorial total are assumed to be fixed. For example, if Los Angeles county had 10% of all employment in the petroleum refining industry in 1981, it would be assumed to have the same 10% share throughout the forecast period.

Method 2 County shares are based on long-term (10 year) growth toward U.S. sectorial share. For example, if it is assumed that the petroleum industry share was 10% of Los Angeles County employment in 1981, and in 1995 will be 15% of all employment at the national level, then between 1981 and 1995 the Los Angeles County employment share of the petroleum industry will move toward the U.S. share of the same industry. Therefore, by 1995 the petroleum industry share will be 15% of all employment in Los Angeles County.

Method 3 Method 3 involves adjusting the 1981 base year county employment share of total sectorial employment in California to be consistent with the sum of all California county sectorial employment (from DRIFS) and the sum of California county total employment for each of the forecast years from CACTEM. This method involves a modification of an adjustment process known as the R.A.S. Technique. It is discussed in more detail in the body of the report.

The results of all three of these methods are county level growth forecasts for each of the 58 California counties in each of the 77 input/output sectors. Method 3 was used to produce the final forecast. After several discussions with the Air Resource Board's Research Division staff about the strengths of that method, it was deemed to be more appropriate than the alternatives.

What follows in the body of this report is a discussion of Method 1 and Method 2 for apportioning State forecasts including the strengths of these methods and the limitations which lead to the conclusion that Method 3 is the appropriate methodology; a detailed discussion of Method 3 including the California County Total Employment Model; and conclusions and recommendations for further work in improving The California Long-Run County Forecasting system (CALCFS).

II. County Forecasting System Alternative Methodologies

A. Method 1

All three of the proposed methods of allocating state output involve as a principal step creating a base year employment share matrix. This matrix has as a column label each of the 77 industries and as a row label each of the 58 California counties. Any one cell identifies the percentage of an individual industry's employment of an individual county's total employment in 1981. The cell data are constructed using 1981 four digit Standard Industrial Classification (SIC) code employment information by county and aggregating it to be consistent with the input-output sector definitions presented in the Appendix. For example, input-output Sector 13 includes the four digit SIC codes 3482, 3483, 3484, 3489, 3761 and 3795. Therefore, for each California county, employment in each of these SIC codes was aggregated to form Sector 13. A similar aggregation was undertaken for each of the input-output Sectors with two exceptions: Sector 1 and Sector 2. Sector 1, Livestock and Livestock Products, and Sector 2, Other Agricultural Products, do not have readily accessible or reliable employment data. However, there is information on the sale of these farm goods (dollar amounts) by California county. The 1981 share of Sector 1 or 2 is its level of sales for that year divided by the total California level.

Forecasting by this particular method becomes a simple process of multiplying each California industry's forecast of employment or output from the DRI Regional Industry Forecasting System (DRIFS) by the county share matrix for each sector for each year of the forecast.

This methodology has strengths and weaknesses which should be reviewed. This may be an appropriate or at least an expedient method for short-term forecasting (less than 4 years), but this method implicitly assumes that the structure of each California county will remain constant. This is a particularly weak assumption given the long-run (10 years) nature of this forecast; it would be difficult to believe that the structure of any California county will remain constant over a ten year period. The major strengths of this method are its simplicity and the fact that it is not computationally demanding or expensive to produce a new forecast.

B. Method 2

There are several ways to introduce shifts in the base year share matrix. In discussions between DRI personnel and the ARB technical staff one such method was suggested and tested. This involves changing each California county sector employment share so that it grows toward the U.S. sector share in 1995, assuming that the 1995 U.S. share is on a long-run equilibrium growth path. Stated differently, for each county i, for each sector j, and for each year k,

$$A_{ijk} = (T_k/15) * \text{County Share } 1981_{ij} + ((15 - T_k)/15) * \text{U.S. Share } 1995_{ij}$$

where T= time interval. For a 15 year period T_k would begin at 15 and decline by 1 for each year to 1.

A= forecasted employment share matrix

This method has some interesting properties but the weaknesses in terms of a practical solution are difficult to overcome.

The result of allowing county sector employment to grow to a national share is to add shares to sectors that may have been zero in the base year. This leads to employment growth in sectors that are unreasonable given the existing county employment pattern. For example, in a small rural county there may be employment gains in sectors such as crude petroleum and natural gas production or conversely there may be employment gains in large urban areas in the agricultural and livestock sectors. Anomalies such as these did exist in an initial forecast and for that reason this method was not considered further.

Consideration of the three methods led to the decision to reject Methods 1 and 2 in favor of Method 3 discussed in chapter three.

III. The California County Employment and Output Forecasting System

Method 3 consists of four distinct parts: (1) the California County Total Employment Model (CACTEM), (2) the DRI Regional Industry Forecasing System (DRIFS), (3) the employment share adjustment process (R.A.S. Method), and (4) the county output and employment forecasts. Each part is discussed separately and then together as a complete system. This will indicate how the forecasting system as a whole interacts.

A. California County Total Employment Model (CACTEM)

The CACTEM model consists of 116 equations, 2 equations for each California County. The result of solving the model is a forecast of total employment for each county to the year 1995. The summary statistics for each stochastic equation are located in Appendix VIII. They are used to define the total employment growth of each county without regard to the sectorial composition of that county. It also gives an added dimension to the forecasting process by enabling the user to add specific information on noneconomic events occurring in a particular county. For example, if someone had knowledge of a plant opening in 1987 that would add 200 workers, that information could be incorporated in the total employment forecast. The effect of adding 200 workers is to increase the share of the counties sectorial employment across all sectors, preserving the interrelated nature of the county sectorial employment.

For this particular forecast the general specification of each of the county employment equations is derived in a similar fashion. It is a two step process. The first step involves creating a county employment series based on the sum of each county's share of total California employment for a particular sector. For a very simple example of this process, consider a state with only two sectors: Agriculture and Manufacturing. County X in this state has 10% of total state agricultural employment and 20% of total state manufacturing employment. In this example total state agricultural and manufacturing employment for 1980-1983 is shown below:

		Agriculture Employment	Manufacturing Employment	Total Employment
	1980	100	1000	1,100
	1981	150	1200	1,350
Year	1982	160	1100	1,260
	1983	180	1120	1,300

Given these totals, the generated County X employment would be calculated as follows:

	Agriculture	Manufacturing	Total County Employment
1980	.10*100=10	.20*1000=200	10+200=210
1981	.10*150=15	.20*1200=240	15+240=255
1982	.10*160=16	.20*1100=220	16+220=236
1983	.10*180=18	.20*1120=224	18+224=242

As can be seen, County X's employment level is calculated by multiplying the county share of each sector times the state total for the sector and summing these county sectorial levels to a county total. Expressed in a different fashion, for each county, i, for each 2 digit SIC code, j, Generated Employment A_i= county weight * 2 digit SIC code California Employment$_j$

where county weight = $\frac{\text{(Value Added or Employment } A_i \text{ SIC Code}_j\text{) 1981}}{\text{(Value Added or Employment CA SIC Code}_j\text{) 1981}}$

The second step invloves bridging the generated employment series to the actual series to form a stochastic equation:

Employment A_i=constant +B* (Generated Employment A_i) + e.

The second step becomes a useful tool in evaluating the error in the first step. From the example above:

Year	Actual County X Employment	Generated Employment
1980	200	210
1981	270	225
1982	270	236
1983	302	242

A regression would then be run using actual employment for County X as the dependent variable and generated employment as the independent variable. An equation would be formed and may appear as follows:

Employment A_i = 20 + .90 (Generated Employment A_i)

Forecasting with the submodel depends on the DRI Regional Information Service (DRIRIS) forecast of employment at the state level which is exogenous to CACTEM. To continue with the example to illustrate this forecast process:

DRI RIS State Forecast

Year		Agricultural	Manufacturing
	1984	190	1200
	1985	200	1300
	1986	210	1400

Generated County X Forecast

	Agriculture	Manufacturing	Sum
1984	.10*190=19	.20*1200=240	259.0
1985	.10*200=20	.20*1300=260	280.0
1986	.10*210=21	.20*1400=280	301.0

County X Forecast of Total Employment then becomes:

Forecast Employment County X = 20 + .90 (Generated Emp. X)

Year	1984	20 + .90 (259)=	253.1
	1985	20 + .90 (280)=	272.0
	1986	20 + .90 (301)=	290.9

The data available for the second step are annual series over the period 1967 to 1982. A dummy variable is generally added to account for the SIC code changes in 1972, and all regressions are run using an AR1 or AR2 correction for serial correlation. All the statistics for the stochastic equations are located in Appendix VIII.

B. The Regional Industry Forecasting System

The Regional Industry Forecasting System is a DRI service that combines the Regional Information Service and the Interindustry Service. The System produces demand forecasts of output and employment for each state and region for 77 industries. The System and associated models are discussed in detail in Appendices V, VI and VII. The results are presented in Appendices I and II.

C. The Employment Share Adjustment Process (R.A.S. Method)

Method 3 for disaggregation of state sector forecasts involves the addition of the California County Total Employment Forecasting Model (CACTEM) and of an adjustment process to the base year share matrix.

The purpose of this section is to describe the adjustment made to the base year share matrix in subsequent years which accounts for growth in county employment and growth in California sectorial employment. The basic method used to make this adjustment is a variant of the R.A.S. method used in updating input/output tables. The R.A.S. method was developed in Cambridge, U.K. around 1960 and is a statistical means of adjusting a matrix to fit new constraints. The basis of the insert R.A.S method suggested in an input-output context by Stone[1] consists of finding a set of multipliers to adjust the columns so that the cells in the adjusted matrix will sum to the required row and column totals relating to the forecast year. The mathematical properties of the

R.A.S. Method have been explored by Bacharach[2] who shows that the method will produce a unique solution. This solution does not depend on whether rows or columns are adjusted first. Also, if a particular cell was zero in the base matrix, it will remain zero in the final matrix and no negative entries will appear in any cells in the final matrix.

There are economic interpretations of the row and column scalars associated with an input-output table adjustment. However, no such economic meaning can be attached to the adjustment of an employment share matrix. Further, convergence based on the I/O matrix is assumed to be based on the fact that the I/O matrix is productive. With a general matrix, convergence is not guaranteed and may present some problems depending on the perturbation of the matrix with regard to the column and row constraints.

[1]Department of Applied Economics, Cambridge University, Input-Output Tables Realtionships, 1954-1966, Volume 3 in A Program for Growth (Chapman and Hall, 1963)

[2]Bacharach, M.O.L., Bi-proportional Matrices and Input-Output Changes, Cambridge University Press, 1969

The multipliers which operate along the rows are denoted as a vector, r, and those which operate on the columns as a vector, s. Each cell of the base share matrix, A_0, will be adjusted by two scalars, and the new matrix, A_1, can be written as

$$A_1 = r\ A_0 s$$

where r and s are matrices with the r and s vectors along the diagonal and zero elsewhere. In order to find the r and s vectors we must introduce the employment level matrix, X_1, which we wish to estimate, and its known row and column totals (in this case row totals are county employment forecasts and column totals are state sector forecasts). The row and column totals are designated U_1 and V_1 respectively. Therefore we have

$$X_1 = A_1 q_1$$

where q_1 is the current sector level

$$=(r\ A_0 s) q_1.$$

The row and column totals of this matrix will be

$u_1 = x_1 i$ where i is the unit vector, substituting we get

$$u_1 = r\ (A_0 q_1) s \qquad (1)$$

and

$$v_1 = x'_1 i$$

$$v_1' = i' x_1$$

$$v_1 = r'(A_0 q_1) s. \qquad (2)$$

These two equations, (1) and (2), contain all the information available -- the base share matrix, a_0, the new row and column constraints, u_1 and v_1, and the current sector employment level q_1. If these equations are solved simultaneously, the values of the r and the s vectors will be found and one could calculate these as

$A_1 = (r\ A_0 s)$ and x_1 ($x_1 = A_1 q_1$).

The solution adopted to these equations is most often an iterative one. Thus, the estimation process of obtaining x_1 from x_0 in effect amounts to nothing more than a proportional adjustment of the base matrix successively along its rows and its columns until convergence is reached.

$$x_1 = r x_0 s$$

i.e.,

$$A_1 q_1 = r\, A_0 q_0 s$$

$$A_1 = r A_0 q_0 q_1^{-1} s$$

An illustration of this method helps to simplify the explanation. Starting with a hypothetical base year employment level matrix, which contains three counties and three sectors, we have:

		Sectors 1	2	3	Total County Employment
Counties	A	50	100	0	150
	B	30	50	20	100
	C	20	50	30	100
Total Sector Employment		100	200	50	Total State Employment 350

a) Step 1 involves the calculation of the first row scalar, R_1. Information available is the county employment forecasts from the county forecasting model.

	1	2	3	Total Base Year Employment	Desired County Employment (forecast)	Row Scalar Row Scalar (R_1)
A	50	100	0	150	160	160/150= 1.066
B	30	50	20	100	150	150/100= 1.50
C	20	50	30	100	120	120/100= 1.20

b) Step 2 involves multiplying base year level employment by row scalars to obtain a new matrix, A_1,

	1	2	3			1	2	3		
A	53.3	106.6	0		A	50	100	0		1.06
B	45	75	30	=	B	30	50	20	*	1.50
C	24	60	36		C	20	50	30		1.20

c) Step 3 invokes the calculation of the first column scalar, S_1 using the new matrix, A_1, by first summing down the columns and then dividing the desired levels by the actual sums of A_1

	1	2	3	
A	53.3	106.6	0	
B	45	75	30	
C	24	60	36	
	122.3	241.6	66	**A_1 Sector Employment**
	100	250	80	**Desired level (from sector forecasts)**
	100/122.3 .8177	250/241.6 1.035	80/66 1.212	**S_1- Column Scalar**

d) Step 4. Multiplication of A_1 by column scalars to create new matrices, A_2

$\underline{A_2}$	$\underline{1}$	$\underline{2}$	$\underline{3}$
$\underline{A}$	43.58	110.33	0
$\underline{B}$	36.80	77.63	36.36
$\underline{C}$	19.62	62.1	43.63

=

	$\underline{1}$	$\underline{2}$	$\underline{3}$
$\underline{A}$	53.3	106.6	0
$\underline{B}$	45	75	30
$\underline{C}$	24	60	36

*

S_1*	.8177	1.035	1.212

e) Step 5 begins the second iteration and the calculation of the second row scalar, R_2. The process involves summing across A_2 and dividing the desired county employment level by the summed values.

	$\underline{1}$	$\underline{2}$	$\underline{3}$	Sum of Rows	Desired Level	$\underline{R_2}$
$\underline{A}$	43.58	110.33	0	153.91	160	160/153.91=1.40
$\underline{B}$	36.8	77.63	36.36	150.79	150	150/150.79=.995
$\underline{C}$	19.62	62.1	43.63	125.35	120	120/125.35=.957

f) Iteration continues as indicated in Steps 2 through 5 until covergence is reached. The convergent matrix is shown here:

		Employment Sector			Total County Employment
		$\underline{1}$	$\underline{2}$	$\underline{3}$	
County	$\underline{A}$	45.3	114.7	0	160
	$\underline{B}$	36.2	76.6	37.2	150
	$\underline{C}$	18.5	58.7	42.8	120
Total Sector Employment		100	250	80	

As the example demonstrates, final convergence produces the desired county employment totals and desired sector totals. Row and column multipliers can be calculated as the product of the multipliers used in each successive round. Thus, the row of multipliers for the first row is equal to

$r_1 * r_2 * r_3 ... * r_n$ in this case

$1.067 * 1.039 * 1.006 * 1.006 * 1.001 * 1.000 = 1.116$

Similarly, the first column multipliers are equal to

$s_1 * s_2 * s_3 * ... * r_n$ in this example

$.817 * .993 * .999 * 1.000 = .8105$

Row and column multiplier vectors produced in this manner are equal to:

$r = (1.116, 1.488, 1.140)$

$s = (.8105, 1.025, 1.20)$

It follows that:

$$\begin{matrix} 45.3 & 114.7 & 0 \\ 36.2 & 76.6 & 37.2 \\ 18.5 & 58.7 & 42.8 \end{matrix} = \begin{matrix} 1.116 & 0 & 0 \\ 0 & 1.488 & 0 \\ 0 & 0 & 1.140 \end{matrix} * \begin{matrix} 50 & 100 & 0 \\ 30 & 50 & 20 \\ 20 & 50 & 30 \end{matrix} * \begin{matrix} .8105 & 0 & 0 \\ 0 & 1.025 & 0 \\ 0 & 0 & 1.20 \end{matrix}$$

D. County Output Sectorial Forecasts

The previous steps have assembled all the necessary information to produce a county level output forecast for each of the 77 industries. From the R.A.S. adjustment process there exists share matrices for the years 1982 through 1995. The DRI Regional Information Forecasting System (DRIFS) produces output forecasts for the state of California for the years 1984 through 1995. The county level output forecasts are simply the state industry total for each industry in each year multiplied by each county's share of that output. Having completed this multiplication results in county level estimates of employment and output for each of the 58 California counties in every year from 1981 to 1984 and forecasts from 1985 to 1995 for 77 industries. The results are presented in Appendices III and IV.

IV. Conclusions

This project is designed to enhance the capabilities of the Air Resources board to produce county level economic projections used in the Air Pollution Emission Inventory Program. This enhancement is designed to provide the capability to utilize:

1) a national economic forecast under differing sets of economic assumptions;
2) a state level economic forecast of 77 input/output sectors consistent with the national assumptions;
3) an apportionment methodology for producing county level forecasts; and
4) a system for integrating all the component parts.

The first two functions are provided by Data Resources Services which deal with the National Economic outlook and the Regional outlook. Forecasts under three differing economic scenarios are produced monthly and made available to subscribers. Tasks 3 and 4 were produced under contract A3-137-32.

What is called Method 3 in the body of the report is the method of choice in apportioning the state employment and output forecasts. Method 3 attempts to introduce a shift in the base year share matrix by accounting for differential sector growth at the State level and differential total employment growth at the county level. This step toward accounting for growth in particular sectors vis-a-vis other sectors and particular counties vis-a-vis other counties that would not be otherwise picked up by a simple fixed share apportionment technique (Method 1). There are, however, improvements that can be made (see Recommendations for Future Study). The system developed integrates all the component parts necessary to utilize Method 3. A forecast was produced using this system for the 58 California Counties in 77 industry detail. The results are presented in Appendices III and IV.

The results of this contract will provide to the ARB more reliable and defensible forecasts of economic activity for California than are currently available.

V. RECOMMENDATIONS FOR FUTURE STUDY

Future contract work with the ARB will be based on the utilization of the economic growth projections made under the terms of this contract. It is DRI's intention to work with the ARB to establish an onging forecasting program which will enable the ARB to update their forecasts on an annual basis. DRI proposes to work with ARB staff to keep appraised of their evolving needs for economic growth forecasts. Based on these current requirements and needs, we propose to refine and expand the California model.

We propose to include California as a tenth region in the regional breakdown of the U.S., and to divide California into several subregions which could correspond to the ARB's emission inventory district classification. By subdividing California into several areas, each area's share of each industry's employment will be explained within the state. This work would overcome the current model's inability to examine intra-California shifts in industrial employment and would provide the ARB with a state-of-the-art California long-run forecasting model.

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. ARB/R-86/270	2.	3. Recipient's Accession No. PB86 233426/AS

4. Title and Subtitle
THE CALIFORNIA LONG RUN COUNTY EMPLOYMENT OUTPUT FORECASTING SYSTEM

5. Report Date
April 1986

6.

7. Author(s)
Lew Hurst

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
Data Resources, Inc.
44 Montgomery Street, Suite 2485
San Francisco, CA 94104

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C) A3-137-32
(G)

12. Sponsoring Organization Name and Address
Air Resources Board
State of California
P.O.Box 2815
Sacramento, CA 95812

13. Type of Report & Period Covered
Final Report

14.
6/84 - 5/86

15. Supplementary Notes
Data contained in Appendicies I, II, III, and IV are available on magnetic tape from the Air Resources Board. Executive Summary is also available from the Air Resources Board.

16. Abstract (Limit: 200 words)

The purpose of this work is to provide the Air Resources Board with a system for updating forecasts of industrial growth factors used in the statewide Emission Inventory System. Of special importance is a method for forecasting industrial growth by counties. Hence, the majority of the work performed under this contract was in developing and implementing a theoretical methodology for apportioning state output to the county level. A proportional matrix adjustment is utilized as the core of the system that apportions the state forecast to the counties. This matrix adjustment process is dependent on state industry forecasts which are provided by the Data Resources, Inc. industry forecasting component and county total employment forecasts. Within the scope of the work, DRI provides a California forecast of employment and real output to the year 1995 and 77 industries and 58 counties.

The system developed provides the ability to forecast state and county output and employment under different sets of economic assumptions which can be used to analyze the effects of national economic changes. It also provides a theoretical methodology for estimating county level sector forecasts for the 58 California counties.

17. Document Analysis a. Descriptors
California Long Run County Employment and Output Forecasting System
Macro-Economic
Input/Output

b. Identifiers/Open-Ended Terms
Economic Forecasts
Employment
Output

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Release Unlimited. Available from National Technical Information Service, 5285 Port Royal Rd Springfield, VA 22161	20. Security Class (This Page)	22. Price A03

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce